UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte VOLKER BECKER,
FRANZ LAERMER and ANDREA SCHILP

Appeal No. 2005-1319
Application 09/581,663

ON BRIEF

Before GARRIS, PAK, and KRATZ, Administrative Patent Judges.

GARRIS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal which involves claims 33, 34, 36-38 and 62.

The subject matter on appeal relates to a method for etching a silicon layered body which includes a first anisotropic, plasma etching process, a second etching process and a third etching process. The method may include building a $(CF_2)_n$ film on trench sidewalls during the first etching process, prior

to the third etching process and/or during the third etching process. Additionally, the third etching process may constitute an isotropic etching process with an etching gas such as chlorine trifluoride or bromine trifluoride. This appealed subject matter is adequately represented by independent claims 33, 34[1] and 36 as well as dependent claim 38, which read as follows:

33. A method for etching a silicon layered body, which has a first silicon layer (15) that is provided with an etching mask (10) for defining lateral recesses (21); work with a plasma being carried out in a first etching process, and trenches (21') being formed by anisotropic etching in the region of the lateral recesses (21); at least one separating layer (12, 14, 14', 16) being buried between the first silicon layer (15) and a further silicon layer (17, 17') and the first etching process coming at least almost to a standstill upon reaching the at least one separating layer; and the separating layer (12, 14, 14', 16) subsequently being etched through in an exposed region (23, 23') by a second etching process, and a third etching process then etching the further silicon layer (17, 17'); wherein a $(CF_2)_n$ film (20) being built up on side walls of the trenches (21') at least one of in the course of the first etching process, prior to the third etching process and during the third etching process.

34. A method for etching a silicon layered body, which has a first silicon layer (15) that is provided with an etching

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[1] In any further prosecution that may occur, the appellants and the examiner should consider whether the claim 34 phrase "etching gases selected from the group xenon difluoride . . ." constitutes improper Markush group language and therefore should read --etching gases selected from the group consisting of xenon difluoride . . .--. See, for example, the Manual of Patent Examining Procedure (MPEP) § 2173.05(h) (Rev. 2, May 2004).

mask (10) for defining lateral recesses (21); work with a plasma being carried out in a first etching process, and trenches (21') being formed by anisotropic etching in the region of the lateral recesses (21); at least one separating layer (12, 14, 14', 16) being buried between the first silicon layer (15) and a further silicon layer (17, 17'), and the first etching process coming at least almost to a standstill upon reaching the at least one separating layer; and the separating layer (12, 14, 14', 16) subsequently being etched through in an exposed region (23, 23') by a second etching process, and a third etching process then etching the further silicon layer (17, 17'); wherein one of an isotropic plasma-etching process and an isotropic etching process with etching gases selected from the group xenon difluoride, chlorine trifluoride, bromine trifluoride, and iodine pentafluoride is used as a third etching process.

36. A method for etching a silicon layered body, which has a first silicon layer (15) that is provided with an etching mask (10) for defining lateral recesses (21); work with a plasma being carried out in a first etching process, and trenches (21') being formed by anisotropic etching in the region of the lateral recesses (21); at least one separating layer (12, 14, 14', 16) being buried between the first silicon layer (15) and a further silicon layer (17, 17'), and the first etching process coming at least almost to a standstill upon reaching the at least one separating layer; and the separating layer (12, 14, 14', 16) subsequently being etched through in an exposed region (23, 23') by a second etching process, and a third etching process then etching the further silicon layer (17, 17'); wherein, after the third etching process, a $(CF_2)_n$ film (20) is deposited on at least one of a portion of the freely accessible silicon surfaces and freely accessible silicon-oxide surfaces.

38. The method as recited in Claim 36, wherein, during the deposition of the $(CF_2)_n$ film (20), ionic bombardment is used which prevents the formation of the film (20) on all locations accessible for perpendicular ion incidence.

The references set forth below are relied upon by the examiner as evidence of obviousness:

Flamm et al. (Flamm)	4,310,380	Jan. 12, 1982
Fujii et al. (Fujii)	5,313,836	May 24, 1994
Tang et al. (Tang)	6,211,092	Apr. 3, 2001

Wolf et al. (Wolf), "Dry Etching for VLSI Fabrication" 1 Silicon Processing for the VLSI Era 539-50 (1986)

Claims 33, 36-38 and 62 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii in view of Wolf and further in view of Tang, and claim 34 is correspondingly rejected over these references and further in view of Flamm.[2]

We refer to the Brief and Reply Brief and to the Answer for a thorough discussion of the opposing viewpoints expressed by the appellants and by the examiner concerning the above-noted rejections.

OPINION

We will sustain each of these rejections for the reasons expressed by the examiner and below.

[2] As indicated on page 6 of the Brief, claim 38 has been grouped and argued separately from claims 33, 36, 37 and 62.

Fujii discloses a method for etching a silicon layered body, which comprises a first anisotropic etching step with an alkaline etching substance such as KOH (lines 39-41 of column 6) followed by second and third etching steps (see lines 42-45 in column 6). This method corresponds to the method defined by independent claims 33 and 36 except for the claim requirement that a plasma be used in the first etching process and the claim requirement that a $(CF_2)_n$ film be built up or deposited.

As more fully detailed by the examiner, it would have been obvious for one with ordinary skill in this art to replace Fujii's anisotropic alkaline etching step with a dry plasma anisotropic etching step of the type and for the reasons taught by Wolf. In support of their contrary view, the appellants argue that "Wolf specifically teaches that plasma etching is **isotropic**" (Reply Brief, page 7). While Wolf indeed teaches that dry processes relying strictly on purely chemical etching mechanisms typically etch in an isotropic fashion (page 41), this reference unquestionably evinces that dry plasma etching is known in the prior art as an effective anisotropic etching mechanism (e.g., see the second full paragraph on page 539 and the paragraph

bridging pages 541 and 542). Under these circumstances, the appellants' argument must be regarded as lacking persuasive merit.

We also share the examiner's conclusion that it would have been obvious for the artisan to provide Fujii's process with polymer formers of the type and for the reasons taught by Tang (e.g., see lines 51-67 in column 5, and lines 6-16 in column 6), thereby resulting in a $(CF_2)_n$ film. For example, this provision would have been motivated by the desire to achieve sidewall passivation as taught by Tang (e.g., see lines 52-59 in column 9) so as to militate for the anisotropic result desired in Fujii's first etching step.

With respect to the aforenoted obviousness conclusion, the appellants present the following argument on page 5 of the Reply Brief:

> Not only are the etching processes disclosed in Fugii and Tang **fundamentally different**, but the **specific etching sequences** disclosed in Fujii and Tang are completely different. Given these differences, it is unreasonable to suggest that one of ordinary skill in the art would be motivated to **selectively pick out** the specific teaching of Tang regarding the application of C_2F_4 film and combine it with the teachings of Fujii and Wolf.

As correctly explained by the examiner, the fact that the etching processes of Fujii and Tang are different does not militate against the obviousness conclusion under review. For example, the polymer film benefits taught by Tang clearly are applicable to the etching method of Fujii as modified by Wolf.

In addition, the appellants argue that "claim 38 is not rendered obvious by the combination of Fujii, Wolf and Tang" (Reply Brief, page 5). From our perspective, it is the examiner's position that the claim 38 feature would have been the necessary and inherent consequence of the etching method resulting from the combined teachings of Fujii, Wolf and Tang. That is, since the method resulting from this combination would include deposition of $(CF_2)_n$ film during ionic bombardment (as in the claim 38 method), film formation necessarily and inherently would be prevented on all locations accessible for perpendicular ion incidence (as required by the claim 38 method). The appellants do not explain and we do not independently understand how it would be possible for the method suggested by the applied prior art and the identical method defined by claim 38 to yield results which are not also identical. Compare In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977). It

follows that the appellants' claim 38 argument is unconvincing of patentability.

Concerning independent claim 34, we again share the examiner's conclusion that it would have been obvious for the artisan to replace Fujii's third isotropic etching step with an isotropic etching process which uses etching gases such as chlorine trifluoride or bromine trifluoride in view of and for the reasons taught by Flamm (e.g., see the paragraph bridging columns 1 and 2, lines 12-63 in column 6, and lines 16-27 in column 7). As correctly explained by the examiner, the artisan would have been motivated to make this provision in order to obtain the benefits taught by Flamm such as a substantially uniform and relatively high etching rate at relatively low power levels (again see the paragraph bridging columns 1 and 2). We are unable to discern any persuasive merit in the appellants' argument that the examiner's proposed combination of these prior art teachings "is simply unreasonable" (Brief, page 13).

For the reasons set forth by the examiner and above, we determine that the examiner has established a prima facie case of unpatentability for the here-argued claims which the appellants

have failed to successfully rebut with argument or evidence of patentability. We shall sustain, therefore, the examiner's § 103 rejection of claims 33, 36-38 and 62 as being unpatentable over Fujii, Wolf and Tang as well as his § 103 rejection of claim 34 as being unpatentable over these references and further in view of Flamm. See In re Oetiker, 977 F.d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

The decision of the examiner is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

BRADLEY R. GARRIS)
Administrative Patent Judge)
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